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# On the systematics of the genus *Trichodinella* Šrámek-Hušek (= *Brachyspira* Raabe)

## O systematyce rodzaju *Trichodinella* Šrámek-Hušek (=*Brachyspira* Raabe)

## I. Introduction

The genus *Trichodinella* Šrámek-Hušek, 1953 was established by Raabe (1950) for urceolarids inhabiting the gills of fresh-water fish. Unfortunately that author named it originally *Brachyspira*, which name had already been pre-occupied for a mollusc, so that Šrámek-Hušek was justified to change this generic name into *Trichodinella*. According to Raabe, the members of this genus are urceolarids with a disc-shaped body with a circular outline and a convex anterior face. Their generic character is a short adoral zone which reaches about 180° (contrary to other urceolarids in which it turns 360° or more). The typical species of the genus is *T. epizootica* from various species of fresh-water fish and its significant feature consists in almost undeveloped centripetal thorns of denticles („les pointes centripétes à peine marquées"). However from the standpoint of our present knowledge it is not certain whether the assortment of ciliates from four different hosts whose denticle number and diameter of the adhesive disc did not coincide really represent one homogenous species.

Another representative of the genus was *T. baltica*, described by Stryjecka-Trembaczowska (1953) from the gills of *Gobius niger*. This species has been adequately described. It differs from *T. epizootica* (according to Raabe's description) quite distinctly, only the shape of denticles was not clearly demonstrated; they are

formed in the same manner as in *T. epizootica*. *T. sphaeronuclea* Lom, 1956, found in the slime beneath the mantle of slugs of the genera *Belzia* and *Limax*, was the third species of the genus, as it seemed to comply with Raabe's generic diagnosis, except for its very different biotope and the fact that its denticles possessed well developed internal thorns. Kazubski (1958), who found this species in another host, *Schistophallus orientalis*, has created a new genus — *Semitrichodina* for this ciliate because of their well developed centripetal thorns. He has based this systematic transposition not directly on Raabe's official generic diagnosis of the genus *Trichodinella* but on the characters of *T. epizootica*, which Raabe quotes in comparison with the species formerly described by Davis under the generic name *Trichodina* (e. g., *T. myakkae*, etc.).

Except for the main criterion for the family *Urceolariidae*, which undoubtedly consists in the development of the adoral zone, the systematics of this family is based on the form of skeletal elements which form the supporting ring of the adhesive disc. In one group, they are developed in the form of smooth pointed „plates", adhering one to another with their obliquely cut ends (*Urceolaria, Trichodinopsis, Polycycla*). In the other group (consisting of *Trichodina, Vauchomia*), these elements are shaped like „denticles" of a complex structure. Each denticle consists of a conical central part with a centripetally extending „thorn" and a centrifugal „blade". The genus *Trichodinella*, which roughly coincides with the latter group as regards the shape of denticles differs, however, from its members in that it has a short adoral zone.

The structure of skeletal elements is therefore of basic importance for the taxonomy of this group. When investigating the protozoan parasites of fish, we have found trichodinellids with or without well developed internal thorns on the gills of several species of fish. It is certain that some more such species will be found in a short time. The question arises whether it is possible still to place all these forms in the genus *Trichodinella* even if they do not agree in such an important character. The second question is what will in this connection be the systematic position of *T. sphaeronuclea*.

The object of the present paper is a description of the ciliates found hitherto and their comparison with some other species described as *Trichodina*. We quote them already as representatives of the new subgenera.

## II. Description of ciliates observed

### Genus *Trichodinella* Šrámek-Hušek

### Subgenus *Trichodinella* s. str.

1. *Trichodinella* (*Trichodinella*) *epizootica* (Raabe, 1950)

A ciliate found on the gills of tenches (*Tinca tinca*) had been previously (Lom, 1956) determined as a representative of this species. According to the shape of its denticles — the blades extend straight in the centrifugal direction — it coincides with Raabe's description; in the other ciliates we found (see the following species) the denticle blades extend obliquely. Since we have presented a more detailed description before (1956) only the fundamental characters are given in Table I.

2. *Trichodinella* (*Trichodinella*) *epizootica* f. *percarum* (Dogiel, 1940)
syn.: *Trichodina domerguei* f. *percarum* Dogiel, 1940

It was found on the gills of perch (*Perca fluviatilis*), the infection being weak. After the fish had been transported into the laboratory and kept for about 7 — 10 days in a small container at indoor temperature, the number of ciliates increased enormously. The ciliates show a remarkable metaboly, an almost amoeboid one, on penetrating through the fissures between the gill plates and on creeping through the cell debris.

The body is circular in outline, but it is sometimes compressed from three sides (Fig. 1). This is caused by the asymmetric manner in which the adoral zone is situated on the anterior face of the animal. It begins just at the margin of the body, and continues over a short distance along the border of the body. It encircles the central hat-like convex part of the anterior face of the animal reaching a course of almost 180° and then plunges into the mouth vestibulum. The convex anterior face is somewhat wrinkled where it is encircled by the adoral zone (Fig. 1 D). The body diameter ranges from 35 to 49 μ, the average being 42 μ.

The adhesive disc, very much inverted inwards in animals attached to the substrate, has about 42 μ in diameter (varying from

Tab
A survey of data of

| Species and author of description | | Diameter of (in μ) | | | Number of denticles | Dimension of a denticle in μ | Number of radial pins |
|---|---|---|---|---|---|---|---|
| | | the body | the adhesive disc | the denticulate ring | | | |
| *T. (Trichodinella) myakkae* (Mueller, 1937) after Davis, 1947 | | / | 21—25 | 11—12 | 17—24 | / | 4—5 |
| *T. (Trichodinella) epizootica* f. *percarum* (Dogiel, 1940) | after Dogiel 1940 | 27(24—38) | / | 14 | 21—24 | / | 6 |
| | | 25(21—27) | / | 13 | 23—26 | / | 6 |
| | our findings | 42 (35—49) | 24 (19—30) | 13 (11—15) | 25 (18—28) | l-3;w-1.2 bl=2.2 | 4 |
| | | 37 (30—45) | 25 (17—30) | 14 (11—18) | 27 (21—30) | almost the same as above | 4—5 |
| *T. (Trichodinella) epizootica* (Raabe, 1950) | after Raabe, 1950 | / | 26(22—30) | 16(13—18) | 23—26 | / | / |
| | | / | 26(24—28) | 15(13—17) | 22—24 | / | / |
| | | / | 24(20—26) | 15(11—17) | 18—24 | / | / |
| | | / | 17(15—20) | 9(8—11) | 22—24 | / | / |
| | after Lom, 1956 | 36(28—44) | 25(19—32) | 14(9—17) | 26(22—30) | / | 4 |
| *T. (Trichodinella) baltica* (Stryj.-Tremb., 1953) | | 22 (17—25) | 15 (12—13) | 8 (7—9) | 18 | / | 6 |
| *T. (Trichodinella) symmetrica* (Davis, 1947) | | / | 24—35 | 13—22 | 25 (21—28) | / | 5 |
| *T. (Tripartiella) carassii* (Dogiel, 1940) | | 23 (19—26) | / | 12—13 | 24 (21—28) | / | 4 |
| *T. (Tripartiella) bursiformis* (Davis, 1947) | | / | 25—35 | 14—18 | 24—27 | / | 5 |
| *T. (Tripartiella) bulbosa* (Davis, 1947) | | / | 22—26 | 10—12 | 21 (19—24) | / | 5—6 |
| *T. (Tripartiella) copiosa* sp. n. | | 36 (26—48) | 25 (18—31) | 13 (9—16) | 27 (21—32) | l-3.3;w-1.5 bl-3.3;t-2.2 | 4(5) |
| *T. (Tripartiella) incisa* sp. n. | | 24 (21—30) | 18 (16—21) | 11 (10—13) | 23 (20—26) | l-3; w-1.3 bl-2.3; t-1.7 | 6(7) |
| *T. (Tripartiella)* sp. | | 32(24—35) | 23(20—27) | 13(12—15) | 24(21—30) | l-4.5;w-1.5 bl-3;t-2.3 | 5(6) |
| *T. (Togielina) simplex* (Raabe, 1959) | | 18(11—22) | 18(15—21) | 8(6.5—9.5) | 18(17—20) | 1=2 | 4 |
| *T. (Togielina) inversa* (Dogiel, 1948) | | 34(33—35) | 19 | 12 | 21(18—22) | / | 6 |
| *T. (Foliella) subtilis* sp. n. | | 26(22—33) | 19(14—24) | 11(7—14) | 23(21—25) | l-3;bl-2.5 | 5 |

/=no data. Dimensions of denticles: l=total length; w=width of the central conical part bl, t=

le I
the genus *Trichodinella*

| The course of adoral zone | Velum | Marginal cilia | Border membrane | Shape of the body | Macronucleus | Micronucleus | Hosts |
|---|---|---|---|---|---|---|---|
| 180—270° | not developed | not observed | well developed | hat-like | horseshoe-shaped | greatly elongated | *Ictiobus bubalus Carpiodes carpio Salvelinus fontinalis* |
| / | / | / | / | / | horseshoe--shaped | elongated length 2.8 μ | *Perca fluviatilis* |
| / | / | / | / | / | horseshoe--shaped | elongated length 2.8 μ | *Acerina cernua* |
| > 180° | not developed | very fine | 2 μ wide | hat-like rather thick | horseshce, diam. 31 | 3 × 1.5 μ | *Perca fluviatilis* |
| >180° | not developed | stout | 2.5 μ wide | the same as above | horseshoe, diam. ca | 3.5 × 1.5 μ | *Acerina cernua* |
| 180° | / | / | / | / | horseshoe--shaped | / | *Esox lucius* |
| 180° | / | / | / | / | as above | / | *Cyprinus carpio* |
| 180° | / | / | / | / | as above | / | *Carassius carassius* |
| 180° | / | / | / | / | as above | / | *Scardinius erythrophthalmus* |
| ±180° | not developed | thin and rather short | / | hat-like | horseshoe--shaped | 4×1 μ | *Tinca tinca* |
| 180° | / | / | / | / | arc--shaped | rounded | *Gobius niger* |
| ± 240° | not developed | fine | developed | shape of rather high hat | horseshoe--shaped | elongated | *Ictalurus puntatus, Margariscus margarita, Rhinichtys astronasus* |
| / | / | / | / | / | horseshoe, diam. 11-16 μ | elongated length 3.6 *u* | *Carassius carassius* |
| ± 180° | not developed | fine | developed | subbonet--like | horseshoe--shaped | / | *Ambloplites rupestris* |
| ± 270° excentric | not developed | not observed | developed | turban--like | horseshoe--shaped | rounded | *Margariscus margarita* |
| ± 180° | not developed | fine | developed | thick, dish-shaped | horseshoe, diam 23 μ | 1 × 2.5 μ | *Rhodeus sericeus* |
| ±200° | not developed | fine | 2 μ wide | dish shaped | horseshoe | / | *Nemachilus barbatulus* |
| ± 220° | not developed | fine | 1.6 μ wide | dish- to hat-shaped | / | / | *Rutilus rutilus* |
| ± 270° | / | / | / | cap-like | horseshoe diam 10 μ | / | *Gobius niger* |
| / | / | / | / | / | horseshoe, diam.26 μ | inside the horseshoe of macron. | *Trichiurus japonicus* |
| ±18o° | not developed | fine | 2 μ wide | hat shaped | horseshoe diam.22 μ | 4× 1.5 μ | *Carassius carassius* |

length of blade and thorn.

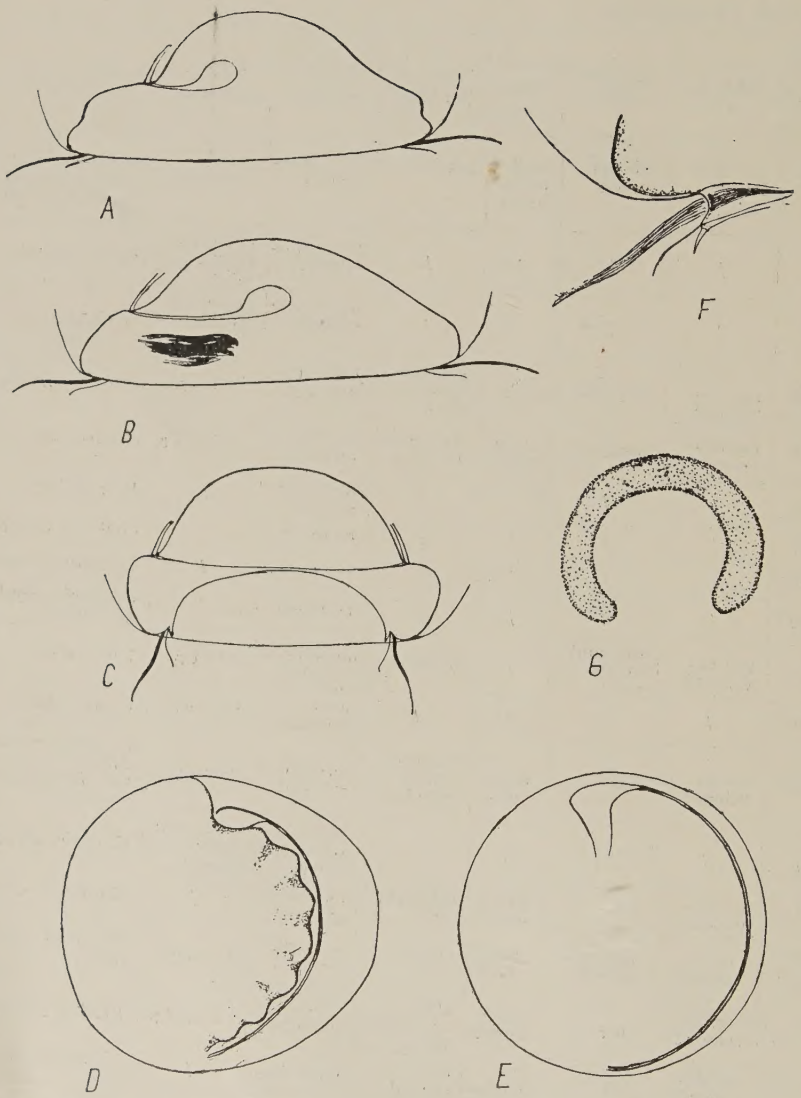


Fig. 1. *T. (Trichodinella) epizootica* f. *percarum* (D o g i e l, 1940). A, B — side views of ciliate; C — side view of settled animal with strongly inwards inverted adhesive disc; D, E — oral views of ciliate, „D" being typical; F — optical section through margin of adhesive disc with two ciliary girdles and marginal cilia; G — shape of macronucleus and micronucleus.

35 to 49 μ). It is skirted by a 2 μ wide, finely striated border membrane. The skeletal ring has a diameter of 11 — 15 μ, with an average of 13 μ, and consists of denticles of a different type from those in *Trichodina*. Each denticle consists of a fine central part and a centrifugal blade. There are no centripetal thorns. The central part (Fig. 4 B) is formed by a hollow narrow and slightly bent little cone the outer side of which extends forward as a rather sharp spike, and it is only behind its anterior point that a flat outer blade is attached. Unlike the crescent-shaped blades of denticles in most *Trichodina* both the anterior and posterior borders of the blades in these species are almost straight, not curved. In the other hitherto observed *Trichodinella* species, the shape of the blades is almost the same. Unlike the previous form of *T.* (*T.*) *epizootica* from tenches its blades are directed obliquely backward (in clockwise rotation in anterior view). When it is alive its denticle blades can be seen with some difficulty. Because of the insignificant dimensions of the denticles and the weakness of their central part, the pressure of the cover-slide often results in a deformation of the dentlicles and the disjunction of the whole ring. The dimensions of the denticles are: width 1.2 μ, length 3.3 μ, blade 2.3 μ. There are 4 radial pins to each denticle.

There are two aboral ciliary girdles, the outer one consisting of fairly strong membranelles and the inner one of fine cilia. There is no septum developed between these girdles. Short and fine marginal cilia originate just above the outer ciliary girdle. They are motionless and protrude obliquely upward. The velum is not distinctly developed, the pellicle above the marginal cilia is broadly vaulted. From the kinetobases of all three ciliary girdles and also from cilia of the adoral zone fine fiberils extend fixed at the central part of the adhesive disc. The macronucleus is horse-shoe-shaped, its outer diameter being about 31 μ. The micronucleus is closely adjacent to its end (the „y" value being about 20 μ), and its dimensions are 3.5 × × 1.5 μ. The adoral zone is furnished with short cilia inclined to the convex anterior middle part of the body. There is no special furrow developed. A contractile vacuole is in a slightly excentric position.

This ciliate was also discovered on *Acerina cernua*. Just when it was caught, no *Trichodinella* could be found on its gills; however, after the fish had been kept separately in a small container, the ciliates multiplied to reach a vast number. The population from *Acerina* differ from the former in a rather smaller body size, averaging

37 μ (30 — 45 μ). It adhesive disc is almost of the same diameter (average 25 μ, varying from 17 to 30 μ) and so is its denticulate ring — 14 μ (11 — 18 μ). The number of denticles differs insignificantly: the peak of frequency curve is 27, the limits being 21 — 30 μ. The denticles are of the same size and form. The populations from *Acerina* represent perhaps a bilogically separated race, since we have not hitherto succeeded in transferring these ciliates to perches.

Subgenus *Tripartiella* subg. n.

3. *Trichodinella (Tripartiella) copiosa* sp. n.

A great number of *Trichodinella* were found on the gills of *Rhodeus sericeus* from Milicov near Prague. At first sight it differs from all trichodinellids described hitherto: the denticles have well developed *Trichodina*-like inner thorns.

The body is very sensitive to environmental changes. When in a normal physiological state, the cialiate is of a circular outline in aboral view, and dish- to hat-shaped in side view. They are continuously attached to the gills, on which they move only very little: if released from the gills, their bodies assume very irregular shapes, become wrinkled, folded or furnished with tips. The diamenter of the body ranges from 26 to 48 μ, the average being 30 μ. The height of the body varies from 8 to 16 μ. The diameter of the adhesive disc ranges from 26 to 48 μ (the average is 25 μ) and is skirted by a 1.5 μ wide finely striated border membrane. On Ag impregnation the denticles and radial pins remain light on a dark background; there is no clear central area. The denticulate ring has 13 μ in diameter (from 9 to 16 μ). The denticles are very small and of a complex structure. Their central conical parts are very fine; even a slight pressure results in loosening the whole ring. To the central part of the denticle a slender inner thorn is attached which is slightly bent and directed obliquely backward. On the outer side the denticle projects into a spike which is directed forward along the outer side of the central part of the preceding denticle. The blade, both borders of which are almost straight, is obliquely directed backward and attached to the above mentioned spike through its stem-like narrow basal part (Fig. 4 A). The auter spikes of the denticles are always closely adjacent to the central part of the preceding denticle so that the denticulate ring (i. e., its central part) looks wider than it would correspond to the width

of the central conical part of the denticle. Were it not for the spikes, the fine central parts of the denticles could not secure the strength to the ring as it is the case in *Trichodina*, for this arrangement gives both strength and flexibility to the ring as a whole in spite of the fineness of the central conical parts. The dimensions of the denticles

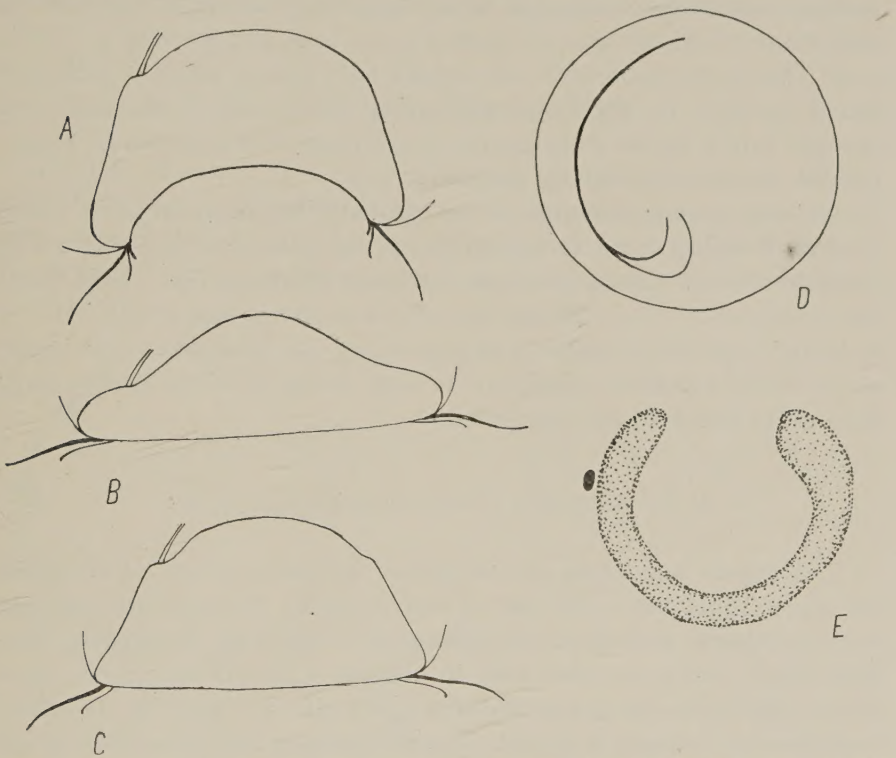


Fig. 2. *T. (Tripartiella) copiosa* sp. n. A — side view of settled animal with vaulted adhesive disc; B — typical side view of the ciliate; C — less common side view of *Tripartiella*; D — oral view; E — shape of macronucleus and micronucleus.

are: length 3.3 μ, width 1.5 μ, thorn 2.2 μ, blade 3.3 μ. There are 4 (exceptionally 5) radial pins to each denticle. The number of denticles ranges from 21 to 32 with an average of 27.

The aboral ciliary apparatus is of the same type as in other species. No septum separates the two aboral ciliary rings. There are about 45 to 50 marginal cilia which originate beneath a somewhat vaulted pellicle, no distinct velum being developed. The marginal cilia curve upward past the vaulted pellicle and are almost motionless.

The cilia of the inner ring are beating toward the centre of the adhesive disc, while the membranelles of the outer ring beat into the sides and thus provide for the ciliate's locomotion.

A horse-shoe-shaped macronucleus, whose arc has an outer diameter of about 23 μ, has some 6 μ in strength. The micronucleus lies on the outer side of the left end of the macronucleus (as seen from oral view), the „y" stretch being 11 μ, and is about 1 × 2.5 μ long. The adoral zone with very short cilia makes about a half turn round the body (± 180°), extends along the border of the body and plunges into a fairly wide mouth vestibulum. The position of a contractile vacuole is slightly excentric.

To this species belongs in all probability, perhaps as a form, *T. (Tripartiella)* found sporadically on the gills of *Gobio gobio*. The denticles are of the same shape, but somewhat smaller. Their number is only about 21 — 23 and the adhesive disc is also smaller (17 — 22 μ) and so is the denticulate ring as far as we have been able to observe. There are four radial pins to each denticle. These preliminary data must however be completed.

### 4. *Trichodinella (Tripartiella) incisa* sp. n.

This ciliate was found on the gills of *Nemachilus barbatulus* from the river Teplá from the east of our republic. It occurred together with a hitherto undetermined species of *Trichodina domerguei*. Unfortunately, we have been able to observe this species only in preparations kindly put at our disposal by Dr. R. E r g e n s. In silver impregnated animals, however, differences have been observed which warrant its separation from the above mentioned species as a new one*.

The denticles, in compared with *T. (T.) copiosa*, are of a different shape. Their thorns extend perpendicularly to the ring, i. e., they are directed centripetally just as the straight centrifugally directed blades. The shape of the blades is also different: it is clear in Plate I, photomicrograph 3. The blade is attached through its „stem" to the outer side of the denticle approximately at the same level at which the thorn is attached to the inner side of the denticle, while in the previous species the place of attachement of the blade is shifted

* After the manuscript had been submitted for publication, we have met this *Tripartiella* again on some other species of fish, so that we could study it in vivo, too.

ahead from that of the thorn. The spike is separated in *T. (T.) incisa* by a broad and deep notch from the anterior border of the blade.

The diameter of the body is about 24 μ (from 21 to 30 μ), that of the adhesive disc from 16 to 21, the average being 18 μ. The diameter of the denticulate ring ranges from 10 — 13 μ (average 11 μ). The number of denticles has its maximum at 23 and ranges from 20 to 26 μ.

### 5. *Trichodinella (Tripartiella)* sp.

A small number of ciliates of this subgenus were found on the gills of *Rutilus rutilus*. We did not succeed in multiplying their number by keeping the fish in a small container as we did with *T. epizootica* f. *percarum*, so that we can present only preliminary date here.

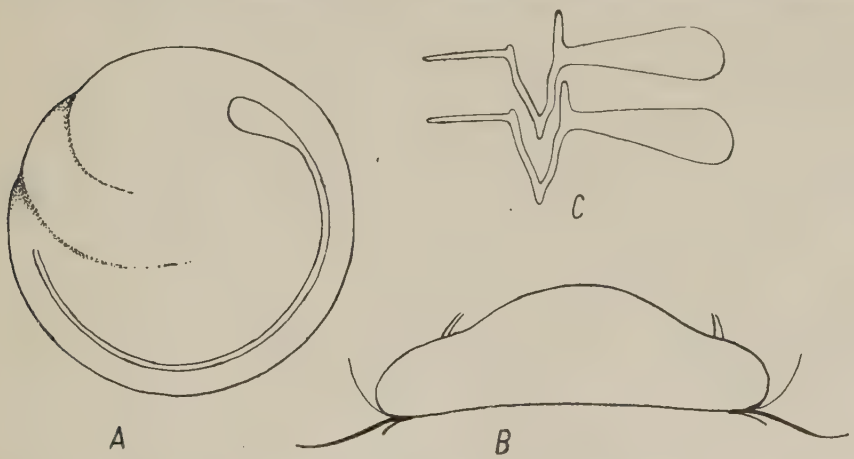


Fig. 3. *T.* (*Tripartiella*) sp. from *Rutilus rutilus*. A — oral view; B — side view; C — two denticles of denticulate ring.

The body is dish-shaped (Fig. 3), circular in outline. On its anterior convex side two typical folds can often be observed. The adoral zone makes slightly more than 380° along the body border. The diameter of the adhesive disc ranges between 20 and 27 μ, that of the denticulate ring from 12 to 15 μ. The number of denticles ranges from 21 to 30, the average being 24. The dimensions of the denticles are: length 4.5 μ, width 1.5 μ, thorn 2.3 μ, blade 3 μ.

This ciliate could also be a form of *T. (T.) incisa*; to clarify its position, however, futher studies are necessary.

## Subgenus *Foliella* subg. n.

### 6. *Trichodinella (Foliella) subtilis* sp. n.

On the gills of crucian carps from indundation pools situated along the river Vltava near Prague ciliates were observed corresponding entirely to the subgenera *Trichodinella* and *Tripartiella*, but their denticles were shaped in a different manner. The central conical part of denticles in fine and narrow, too, but the centripetal projections (Fig. 4 C) hav the form of a rounded little plate. The outer side of

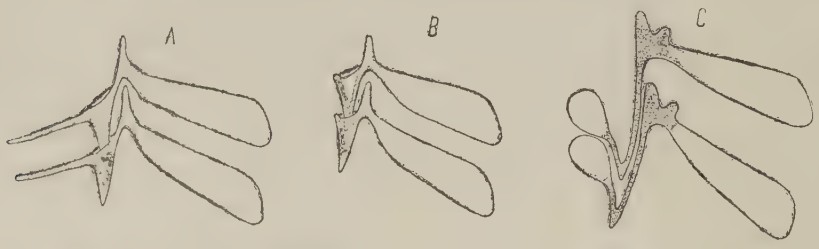


Fig. 4. Denticles of three different representatives of the genus *Trichodinella*. A — *T. (Tripartiella) copiosa* sp. n., B — *T. (Trichodinella) epizootica* f. *percarum* (D o g i e l, 1940); C — *T. (Foliella) subtilis* sp. n. Denticles drawn in optical section, surface of central par not represented.

the central conical part of the denticles runs out forward as a long branch ended by two broadly rounded spikes. The inner spike is closely adjacent to the branch of the preceding denticle; the second shorter one is directed obliquely centrifugally. Beneath this second spike a narrow base of the blade is attached which gradually widens to its centrifugal end. The blades are directed obliquely backward. So far only sparse populations have been discovered, so that further study of their biometrical characters is urgently needod. The biometrical and other data see Table I.

## III. D i s c u s s i o n

To the above mentioned species as well as to those quoted in the introduction to this paper there should be added some others which have been described before under the generic name *Trichodina*. Besides the species *T. myakkae* and *T. symmetrica* D a v i s, 1947, already quoted by R a a b e (1950) the former author also described

the species *T. bursiformis* and *T. bulbosa* D a v i s, 1947 which according to their morphology, are true *Trichodinella*. This is also the case of D o g i e l' s (1940) *T. domerguei* f. *percarum*, *T. domerguei* f. *meridionalis* from *Syngnathus* and *T. carassii* D o g i e l from *Carassius*. The principal features of all these ciliates are listed in Table I.

The denticles of all these and the above described forms differ essentially in structure from those of *Trichodina*. Their central parts, which are inserted one into another, are much finer, their outer side projecting into a spike, directed forward. This spike is closely adjacent to the central part of the preceding denticle and makes the connection of the denticles firmer. The blade of the denticles has a different shape and is attached to the central part in a different manner. However, from the point of view of the importance of the skeletal organellae in the taxonomy of these ciliates, we have to separate these otherwise very similar forms into three groups according to the evolution of the centripetal part of the denticle (thorn). We propose to consider those groups as subgenera. This will secure adequate systematic separation for the time being while future investigations may prove them to be independent genera or not. The fact that they would thus belong to a single genus lays stress on the uniformity of their other characters and bionomy.

Quite recently, R a a b e (1959) described from the gills of *Gobius niger* from the Baltic a further interesting trichodinellid under a new generic name — *Dogielina simplex*. It agrees in all characters with the above mentioned trichodinellids, but its denticles are of a peculiar appearance: the conical part is, according to R a a b e's description, weakly developed, the inner thorn is lacking and the outer blade of the denticles is rounded and triangular in outline. The central part does not project into a spike; this detail is lacking. However, the structure of the denticles does not go beyond the diversity of forms shown by the above mentioned three groups and so we propose to maintain it in the genus *Trichodinella* as its fourth subgenus.

The genus *Trichodinella* can therefore be placed into the system of the family *Urceolariidae* (as it has been outlined in a previous paper — L o m, 1958) as a collection of ciliates characterized by the following generic features:

1) the adoral zone makes an arc less than 270° (*T. myakkae*, *Dogielina simplex*), but in most cases about 180°.

2) the denticles are of a different structure than those in *Trichodina*. Their central parts are usually much finer (with the exception of *Dogielina* they run out into spikes directed forward), the blades are not crooked, but have almost straight borders, and the way they are attached to the central part differs from that in *Trichodina*.

3) the body dimensions and the number of elements of the adhesive disc are smaller than in *Trichodina*.

4) in contradistinction to *Trichodina* trichodinellids inhabit almost exclusively the surface of the fish gill.

We should recall the occurrence of trichodinellids on the gills of tadpoles — like in *Trichodina*, see Lom, 1959. So *T. (Foliella) subtilis* was found on the gills of *Rana esculenta* tadpoles, which lived in the same pool as crucian carps did. Its infection is brought about by a direct transfer of the ciliate from the obligatory host to the facultative one.

The genus *Trichodinella*, characterized by the above four points, is to be divided, according to the structure of the denticles, into four subgenera:

A. centripetal parts not developed:
1. denticle consisting of very fine central part and of rounded blade .... subg. *Dogielina* Raabe, 1959; *T. (D.) simplex* Raabe, 1959; *T. (D.) inversa* (Dogiel, 1948).
2. outer side of central part of denticle projecting into spike directed forward ..... subg. *Trichodinella* s. str.; *T. (T.) epizootica* Raabe, 1950; *T. (T.) myakkae* (Mueller, 1937), *T. (T.) baltica* Stryj.-Tremb., 1953.

B. centripetal parts developed:
1. as thin, rounded little plates ..... subg. *Foliella* subg. n.; *T. (F.) subtilis* sp. n.
2. as *Trichodina*-like thorns ..... subg. *Tripartiella* subg. n.; *T. (T.) copiosa* sp. n.; *T. (T.) incisa* sp. n.; *T. (T.) bursiformis* (Davis, 1947); *T. (T.) bulbosa* (Davis, 1947); *T. (T.) meridionalis* (Dogiel, 1940); *T. (T.) carassii* (Dogiel, 1940).

This division into subgenera may be somewhat modified when the investigations of all trichodinellids from the fish gills are completed. There could perhaps be some transition forms between these subgenera (such as *Trichodinella* from *Esox* to be described in a following paper). This we think is also an argument against the separation of these ciliates into independent genera.

According to Kazubski's diagnosis, the genus *Semitrichodina* created by him and the subgenus *Tripartiella* would perhaps seem to

belong to one single category. This is not the case, since *Semitrichodina* differs in its generic characters:

1) the short adoral zone hardly reaches 180° and extends from the border of the body obliquely to its centre.

2) its denticles are *Trichodina* like in their relatively strong central parts and even thorns. The blades do not resemble the blades in trichodinellids because they are crooked.

Besides these two principal contradictions there are still differences in:

3) entirely different biotope,

4) larger dimensions of the body the surface of which is regularly furrowed with oblique grooves.

Into this pattern of four subgenera of the genus *Trichodinella* also the species described by D a v i s (1947) and D o g i e l (1940, 1948) can be placed. The specific position of *Trichodina symmetrica* cannot, however, be exactly and definitely determined, in all probability it is a mixture of two species, since its denticles are once presented as having a centripetal thorn, while in another drawing there is no thorn. When describing *T. domerguei* f. *meridionalis* D o g i e l stressed several different resemblances of the denticulate ring of this species: the denticles in his drawing of the population from *Syngnathus* from the Black Sea correspond entirely to the subgenus *Tripartiella,* so that it can be classified as *T.* (*Tripartiella*) *meridionalis* (D o g i e l, 1940).

D o g i e l' s species *T. domerguei* f. *percarum* is evidently identical with the ciliate we have found ourselves. The resemblance would have certainly been much greater if this author had collected measurements of a greater number of ciliates. The different number of radial pins to one denticle in D o g i e l' s description (6) can perhaps be explained by inadequate observation. The species *Trichodina carassii* is to be taken for *T. (Tripartiella) carassii* (D o g i e l, 1940), as it is obvious from D o g i e l' s findings and drawing of the denticles. It is interesting to note that we have found not only another species but even a subgenus — *T. (T.) subtilis* on the gills of *Carassius carassius.* Also the species *T. inversa* D o g i e l, 1948, as far as it can be assumed from D o g i e l's description, is to be taken for *T. (Dogielina) inversa* (D o g i e l, 1948).

The question of host specificity of trichodinellids is still open: from the material collected hitherto we cannot decide to what extent

a trichodinellid is bound to the gills of a certain host. Besides the species described, we have also found *T.* (*T.*) *epizootica* f. *percarum* and *T.* (*F.*) *subtilis* on the gills of *Rutilus rutilus* as well.

## IV. Conclusions

1) The genus *Trichodinella* Šrámek-Hušek, 1953 (= *Brachyspira* Raabe, 1950) has been divided into three new subgenera: *Trichodinella* sensu stricto, *Tripartiella* and *Foliella*. The genus *Dogielina* Raabe, 1959 is regarded as another subgenus of *Trichodinella*. These groups differ in the structure of skeletal elements (denticles) of the adhesive disc. A diagnosis of these subgenera is given as well as descriptions of its members on fish in Czechoslovakia as well as of ciliates hitherto described under different generic names.

2) The relation of the genus *Semitrichodina* to the subgenera of *Trichodinella* is determined and its new generic diagnosis is given.

3) Like ciliates of the genus *Trichodina*, trichodinellids were found to be capable of a facultative life on the gills of tadpoles.

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## STRESZCZENIE


Autor dokonywa zestawienia opisów orzęsków pasożytnych z rodziny *Urceolariidae*, które odpowiadają ogólnie rodzajowi *Trichodinella* Šrámek-Hušek (= *Brachyspira* Raabe). Na podstawie analizy tych opisów oraz własnych badań, autor rozszerza nieco definicję rodzaju *Trichodinella* Šramek-Hušek, za istotną jego cechę uważając skrócenie spirali adoralnej do łuku 180° — 270°. Pewne rozbieżności w budowie ogniw wieńca szkieletalnego tych orzęsków skłaniają autora do wyodrębnienia w rodzaju *Trichodinella* Šrámek-Hušek czterech podrodzajów, a mianowicie:

Subgenus *Trichodinella* s. str. charakteryzujący się brakiem dośrodkowych kolców, lecz silnym rozwojem zewnętrznej części trzonów ogniw wieńca. Podrodzaj ten obejmuje dotychczas 4 gatunki.

Subgenus *Dogielina* (Raabe, 1958) charakteryzujący się wybitną redukcją całego trzonu ogniw wieńca szkieletalnego. Podrodzaj ten obejmuje 2 gatunki.

Subgenus *Foliella* subg. n. charakteryzujący się posiadaniem wewnętrznych części ogniw w postaci okrągłych tarcz. Podrodzaj ten obejmuje 1 gatunek *T. (F.) subtilis* sp. n.

Subgenus *Tripartiella* subg. n. charakteryzujący się występowaniem dośrodkowych kolców wieńca szkieletalnego. Podrodzaj ten obejmuje 5 gatunków, w czym dwa nowe *T. (T.) incisa* sp. n. i *T. (T.) copiosa* sp. n.

Autor pozostawia poza rodzajem *Trichodinella* Šramek-Hušek rodzaj *Semitrichodina* Kazubski, 1958 jako rodzaj odrębny, wyróżniający się zarówno budową aparatu szkieletalnego jak i pasożytowaniem w mięczakach.

Autor czyni obserwacje, że wiele z opisanych gatunków z rodzaju *Trichodinella*, podobnie jak i wiele gatunków rodzaju *Trichodina*, będących pasożytami skrzeli ryb, może występować również na skrzelach kijanek żab.

## PLATE I

Phot. 1. Impregnated adhesive disc of *T. (Tripartiella) copiosa* sp. n. Note slender central parts of denticles, from which the forward directed spikes arises (Klein)

Phot. 2. Isolated adhesive disc of *T. (T.) copiosa* sp. n. in unstained preparation. Radial pins and denticles visible.

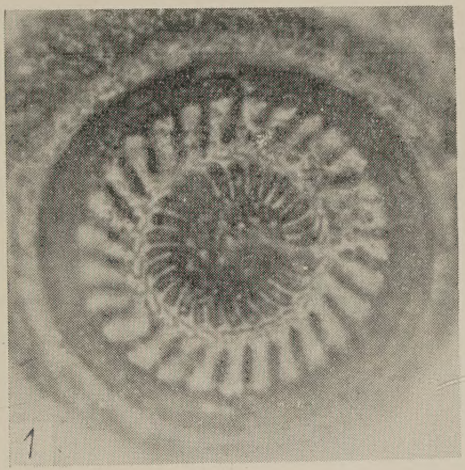
Phot. 3. Denticles of an impregnated adhesive disc of *T. (Tripartiella) incisa* sp. n.

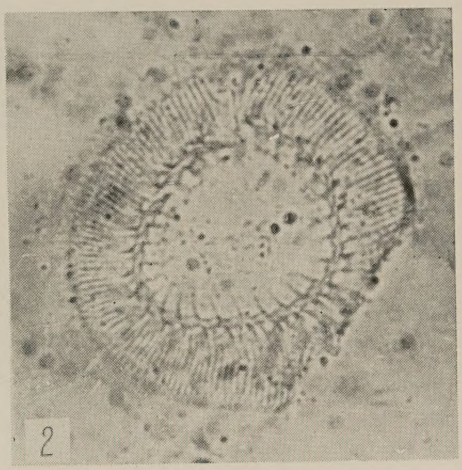
Phot. 4. Unstained preparation of adhesive disc of *T. (Trichodinella) epizootica* f. *percarum* (Dogiel, 1940).

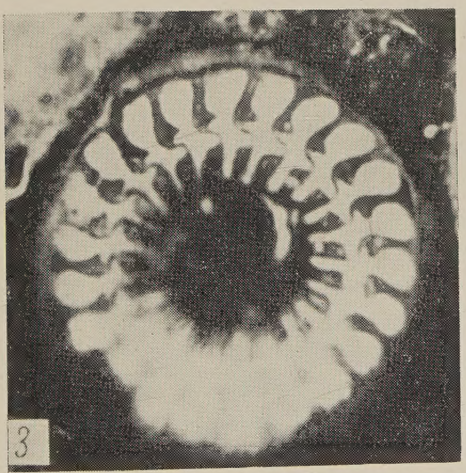
Phot. 5. Unstained preparation of adhesive disc of *T. (Foliella) subtilis* sp. n.

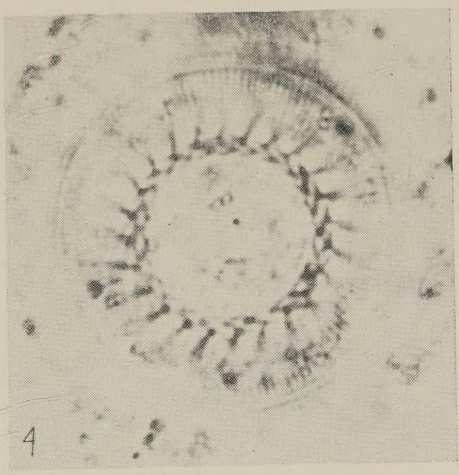
Phot. 6. Unstained preparation of adhesive disc of *T. (Tripartiella)* sp. from *Rutilus rutilus*.

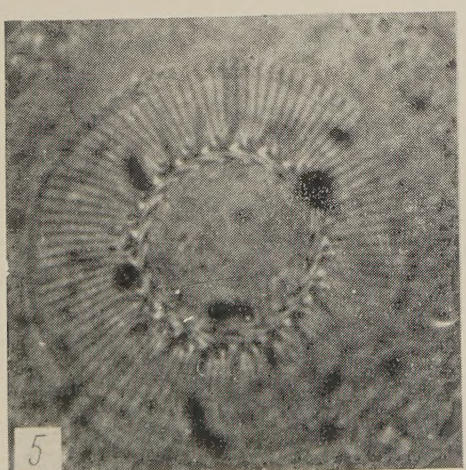
All microphotographs are made with oil immersion (100 ×).

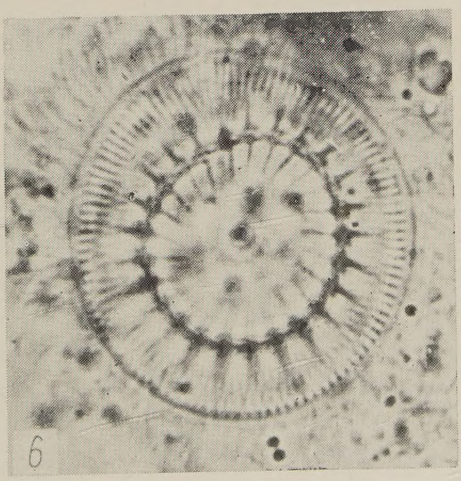



J. Lom

auctor phot.